## Section 3.4 ~ Critical Facilities and their Vulnerability

The next step in determining Merrimack's overall vulnerability was to inventory the Town's community assets and determine what assets would be affected by each type of hazard event. The Hazard Mitigation Team began by reviewing the Merrimack Zoning Ordinance to provide information on where and how the Town builds and to identify the corridors where critical facilities would likely be located. The Team then identified the broad categories of important assets within Merrimack, including critical facilities essential to health and welfare; vulnerable populations, such as children and the elderly; economic assets and major employers; areas of high-density residential and commercial development; and historic, cultural, and natural resources. The Team then further divided the Town's critical facilities into the following categories:

1. **General Occupancy**
    a. Residential
    b. Commercial
    c. Industrial
    d. Agriculture
    e. Religion
    f. Government
    g. Education
2. **Essential Facilities**
    a. Fire Station
    b. Police Station
    c. Department of Public Works
    d. Schools
    e. Emergency Operations Centers
    f. Medical Care Facilities
3. **Transportation Systems**
    a. Highway Systems
    b. Railway Systems
    c. Bus Facilities
    d. Airport Systems
4. **Utility Systems**
    a. Potable Water
    b. Drinking Water
    c. Oil/Propane Facilities
    d. Natural Gas Facilities
    e. Electric Power
    f. Communications
5. **High Potential Hazard Facilities**
    a. Dams/Levees
    b. Nuclear Power Plants
    c. Military

### 6. Hazardous Materials Facilities (http://www2.epa.gov/toxics-release-inventory-tri-program)

The critical facilities within each category appear in the Tables 6.1-6.6 below. Each table includes the critical facility's name, content vulnerability, and locational vulnerability to hazards.

**Table 6.1—General Occupancy Critical Facilities**

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Commercial—Home Depot | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—PC Connection | Potentially large population present, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—Fidelity Corporation | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—Value Added Services | Potentially large population present, located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—Merrimack Outlets | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—Holiday Inn Express | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—Days Inn | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—Merrimack Inn & Suites | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—Atrium Medical | Potentially large population present, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Commercial—Cinemagic | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Education—Thomas Moore College | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Government—NH DOT Turnpike Maintenance Facility | Backup fuel for Merrimack | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Government—Adult Community Center | Potentially large population present, shelter for up to 50 | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Government—Merrimack Public Library | Potentially large population present, official records and documents | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Government—Merrimack Town Hall complex | Potentially large population present, official records and documents | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Government—Merrimack District Court | Potentially large population present, official records and documents | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—Jones Chemical | Hazardous materials present, located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—Circuit Technology | Hazardous materials present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—Nashua Corporation | Hazardous materials present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—Anheuser-Busch Brewery and athletic fields | Hazardous materials present, potentially large population present (public events) | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—BAE Systems | Hazardous materials present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—Saint Gobain | Hazardous materials present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—Nanocomp | Hazardous materials present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Recreation—Abbie Griffin Park | Potentially large population present | ✓ | | | | n/a | | ✓ | | | |
| Recreation—Watson Park | Potentially large population present | ✓ | | | | n/a | | ✓ | | | |
| Recreation—Twin Bridges/Kids Cove | Potentially large population present | ✓ | | | | n/a | | ✓ | | | |
| Recreation—Wasserman Park | Potentially large population present | ✓ | | | | n/a | | ✓ | | | |
| Recreation—Kollsman Field | Potentially large population present | ✓ | | | | n/a | | ✓ | | | |
| Recreation—Merrimack Veteran's Memorial Park | Potentially large population present | ✓ | | | | n/a | | ✓ | | | |
| Recreation—Turkey Hill ball fields | Potentially large population present, located in 0.2% annual floodplain | ✓ | | | ✓ | n/a | | ✓ | | | |
| Recreation—Camp Sargent | Potentially large population present | ✓ | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Recreation—YMCA | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—Grace Baptist Church | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—First Congregational Church of Merrimack | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—Our Lady of Mercy Church | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—Merrimack Valley Baptist Church | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—St. James United Methodist Church | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Religious—Faith Episcopal Church | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—St. John Newman Church | Potentially large population present, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—Riverside Christian Church | Potentially large population present, located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—Merrimack Baptist Temple | Potentially large population present | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Religious—Kingdom Hall | Potentially large population present, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Residential—Rose Haven | Elderly housing, large population present, contents have personal value to owners | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Residential—Wentworth Place | Elderly housing, large population present, contents have personal value to owners | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Residential—Parker Village | Elderly housing, large population present, contents have personal value to owners | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |

**It is beyond the scope of this project to determine whether each general occupancy facility is located in the fluvial erosion hazard zone. A mapping exercise such as this has been included as a mitigation action in Section 4.2 of this Plan Update.*

**Table 6.2—Essential Facilities**

| Facility Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Police Station Headquarters | Contents and staff valuable to emergency management. Serves as communications/dispatch center, backup Emergency Operations Center. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Central Fire Station No. 1 (Headquarters) | Contents and staff valuable to emergency management. Serves as Emergency Operations Center, backup communication/dispatch center. Located in 0.2% annual floodplain. | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Reed's Ferry Fire Station No. 3 | Contents and staff valuable to emergency management. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| South Merrimack Station No. 2 | Contents and staff valuable to emergency management. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Public Works Highway Facility | Contents valuable to transportation network and public infrastructure. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Government—Solid Waste Transfer Facility | Potentially large population present, used during cleanup efforts after hazard event | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Jones Chemical | Critical to water purification throughout east coast and Cananda, located in 0.2% annual floodplain | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Merrimack High School | Potentially large population present. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Merrimack Middle School | Potentially large population present. Shelter for up to 1,000. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mastricola Upper Elementary School | Potentially large population present. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mastricola Elementary School | Potentially large population present. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

| Facility Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Reeds Ferry Elementary School | Potentially large population present. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Thornton's Ferry Elementary School | Potentially large population present. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dartmouth Hitchcock Medical Center | Contents valuable to public health, large staff and population present | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Home and Health Hospice Care | Contents valuable to public health, large staff and population present | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| St. Joseph Medical Center | Contents valuable to public health, large staff and population present | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Southern NH Health System, Merrimack Medical Center | Contents valuable to public health, large staff and population present | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

**Table 6.3—Transportation Critical Facilities**

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Highway System—Daniel Webster Highway | Structure valuable to motor vehicle travel and safety, evacuation route; portion of DW Highway ovr Baboosic Brook immediately north of Wire Road is located in Very High Fluvial Erosion Hazard Zone. | | ✓ | | | ✓ | ✓ | | ✓ | ✓ | |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Highway System—Wire Road from DW Highway to Bedford Road | Structure valuable to motor vehicle travel and safety, evacuation route; portions of Wire Road between DW Highway and Everett Turnpike border Very High Fluvial Erosion Hazard Zone along Baboosic Brook. | | ✓ | | | ✓ | ✓ | | ✓ | ✓ | |
| Highway System—Baboosic Lake Road east and west from DW Highway to Amherst town line | Structure valuable to motor vehicle travel and safety, evacuation route | | ✓ | | | | ✓ | | ✓ | ✓ | |
| Highway System—FE Everett Turnpike north and south from Bedford town line to Nashua city line | Structure valuable to motor vehicle travel and safety, evacuation route; portion of FE Everett Turnpike over Baboosic Brook is located in Very High Fluvial Erosion Hazard Zone. | | ✓ | | | ✓ | ✓ | | ✓ | ✓ | |
| Highway System—Amherst Road east and west from Continental Blvd to Amherst town line | Structure valuable to motor vehicle travel and safety, evacuation route | | ✓ | | | | ✓ | | ✓ | ✓ | |
| Highway System—Continental Blvd east and west from DW Highway to Route 101A | Structure valuable to motor vehicle travel and safety, evacuation route | | ✓ | | | | ✓ | | ✓ | ✓ | |
| Highway System—bridge over Baboosic Brook at Stowell Road | Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain and 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Highway System—bridge over Baboosic Brook at Wire Road | Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Highway System—bridge over Souhegan tributary at Amherst Road | Structure valuable to motor vehicle travel and safety | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Highway System—bridge over Baboosic Brook at Bedford Road | Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Highway System—bridge over Baboosic Brook at Route 3 | Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Highway System—bridge over Baboosic Brook at Bean Road | Structure valuable to motor vehicle travel and safety, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Highway System—Access Road near Loop Road Culvert over Baboosic Brook | Structure valuable to motor vehicle travel and safety, received Mostly Compatible rating, located in 1% annual floodplain | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | |
| Highway System—Bean Road Culvert over Baboosic Brook | Structure valuable to motor vehicle travel and safety, received Partially Compatible rating, located in 1% annual floodplain | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Highway System—Bedford Road Culvert over Baboosic Brook | Structure valuable to motor vehicle travel and safety, received Mostly Incompatible rating, located in 1% annual floodplain | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |
| Railroad System—railroad bridge at Depot Street | Structure valuable to rail travel and safety, located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Railroad System—railroad bridge at Griffin Street | Structure valuable to rail travel and safety, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Railroad System—railroad bridge over Souhegan River at Railroad Ave | Structure valuable to rail travel and safety, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Railroad System—railroad bridge over Pennichuck Brook at Amherst Road | Structure valuable to rail travel and safety | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Railroad System—railroad bridge over Horseshoe Pond outlet | Structure valuable to rail travel and safety, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Railroad System—railroad bridge over Pennichuck Brook | Structure valuable to rail travel and safety, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Railroad System—railroad crossing at Mast Road | Critical to access wastewater treatment | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Airport Systems—FAA Center | Structure valuable to air traffic control | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

**The field assessment protocol used to determine fluvial erosion hazard zones was only able to determine potential structural vulnerability in culverts and cannot be applied to bridges.*

**Table 6.4—Utility Systems**

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Communication—Fair Point Communications | Structure valuable to communications | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Communication—Fair Point Communications | Structure valuable to communications | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Communications—repeater at Hutchinson Road | Structure valuable to communications | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Communications—voter at MPO | Structure valuable to communications | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Electric—PSNH sub-station at Bedford town line | Structure valuable to utility network | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Electric—PSNH sub-station at Star Drive | Structure valuable to utility network | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Electric—PSNH sub-station at Front Street | Structure valuable to utility network | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Electric—PSNH sub-station at Railroad Ave | Structure valuable to utility network | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Electric—PSNH lines at McGraw and DW Highway | Structure valuable to utility network | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Electric—PSNH lines at 411 DW Highway (Fairpoint Switching Network) | Structure valuable to utility network | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Electric—PSNH lines at 239 DW Highway | Structure valuable to utility network | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Oil/Propane—Bot-L-Gas | Contents valuable to energy supply, propane distributor; 90,000 gallon tank | | ✓ | | | n/a | ✓ | ✓ | | ✓ | |
| Oil/Propane—Rochette's Oil Service | Contents valuable to energy supply, propane distributor | | ✓ | | | n/a | ✓ | ✓ | | ✓ | |
| Water—Merrimack Village District office | Water District office | | ✓ | | | n/a | ✓ | ✓ | ✓ | ✓ | ✓ |
| Water—Hutchinson Road water tower | 1,000,000 gallons; structure valuable to water supply | ✓ | ✓ | | | n/a | ✓ | | | ✓ | |
| Water—Turkey Hill water tower | 5,000,000 gallons; structure valuable to water supply | ✓ | ✓ | | | n/a | ✓ | | | ✓ | |
| Water—Parker Drive water tower | 600,000 gallons; structure valuable to water supply | ✓ | ✓ | | | n/a | ✓ | | | ✓ | |
| Water—Merrimack Village District Well #2 | Structure valuable to water supply, located in 0.2% annual floodplain | ✓ | | | ✓ | n/a | | | | | |
| Water—Merrimack Village District Well #3 | Structure valuable to water supply, | ✓ | | | | n/a | | | | | |
| Water—Merrimack Village District Well #4 | Structure valuable to water supply, located in 0.2% annual floodplain | ✓ | | | ✓ | n/a | | | | | |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Water—Merrimack Village District Well #5 | Structure valuable to water supply, located in 0.2% annual floodplain | ✓ | | | ✓ | n/a | | | | | |
| Water—Merrimack Village District Well #7 | Structure valuable to water supply, located in 1% annual floodplain | ✓ | | | ✓ | n/a | | | | | |
| Water—Merrimack Village District Well #8 | Structure valuable to water supply, located in 1% annual floodplain | ✓ | | | ✓ | n/a | | | | | |
| Wastewater—Pennichuck Wastewater pumping station at Mast Rd | Structure valuable to sewage pumping, located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | | | |
| Wastewater—Thornton's Ferry sewage pumping station at Greely Rd | Structure valuable to sewage pumping, located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | | | |
| Wastewater—Souhegan sewage pumping station at Railroad Ave | Structure valuable to sewage pumping, located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | | | |
| Wastewater—sewage pump station at Pearson Road | Structure valuable to sewage pumping | | ✓ | | | n/a | ✓ | ✓ | | | |
| Wastewater—sewage pump station at Burt Street | Structure valuable to sewage pumping | | ✓ | | | n/a | ✓ | ✓ | | | |
| Wastewater—Pennichuck Square sewage pump station | Structure valuable to sewage pumping, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | | | |
| Wastewater—exposed sewer pipe over Baboosic Brook | Structure valuable to sewage treatment, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | | | |
| Wastewater—exposed sewer pipe over Horseshoe Pond outlet | Structure valuable to sewage treatment | | ✓ | | | n/a | ✓ | ✓ | | | |
| Wastewater—Railroad Ave siphon station, inlet | Structure valuable to sewage treatment | | ✓ | | | n/a | ✓ | ✓ | | | |
| Wastewater—Railroad Ave siphon station, outlet | Structure valuable to sewage treatment | | ✓ | | | n/a | ✓ | ✓ | | | |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wastewater—80 Acres siphon station, inlet | Structure valuable to sewage treatment, structure located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | | | |
| Wastewater—80 Acres siphon station, outlet | Structure valuable to sewage treatment, structure located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | | | |
| Wastewater—Mallard Point siphon station, inlet | Structure valuable to sewage treatment, structure located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | ✓ | | | |
| Wastewater—Mallard Point siphon station, outlet | Structure valuable to sewage treatment | | ✓ | | | n/a | ✓ | ✓ | | | |
| Wastewater—Conifer Street siphon station, inlet | Structure valuable to sewage treatment | | ✓ | | | n/a | ✓ | ✓ | | | |
| Wastewater—Conifer Street siphon station, outlet | Structure valuable to sewage treatment | | ✓ | | | n/a | ✓ | ✓ | | | |

**It is beyond the scope of this project to determine whether utility infrastructure is located in the fluvial erosion hazard zone. A mapping exercise such as this has been included as a mitigation action in Section 4.2 of this Plan Update.*

**Table 6.5—High Potential Hazard Facilities**

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Stump Pond Dam<br>Location—42.805 lat, -71.5583 long<br>Hazard Class—L<br>Water body—Farley Brook<br>Owner—Town of Merrimack | Structure valuable to flood control, located in 0.2% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Naticook Lake Dam<br>Location—42.8216 lat, -71.5252 long<br>Hazard Class—L<br>Water body—Naticook Brook<br>Owner—Town of Merrimack | Structure valuable to flood control, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Meadow Wood Pond Dam<br>Location—42.8652 lat, -71.5236 long<br>Hazard Class—L<br>Water body—Souhegan River tributary<br>Owner—Town of Merrimack | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Fish Pond Dam<br>Location—42.8936 lat, -71.47 long<br>Hazard Class—NM<br>Water body—Dumpling Brook<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Watson Dam<br>Location—42.8452 lat, -71.5316 long<br>Hazard Class—NM<br>Water body—Watson Brook<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Farm Pond Dam<br>Location—42.89327 lat, -71.512853 long<br>Hazard Class—NM<br>Water body—unnamed stream<br>Owner—privately held | Structure valuable to flood control, located in 1% annual floodplain | | ✓ | | ✓ | n/a | ✓ | | ✓ | ✓ | |
| Watson Brook Pond Dam<br>Location—42.8427 lat, -71.533 long<br>Hazard Class—NM<br>Water body—Watson Brook<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Recreation Pond Dam<br>Location—42.8666 lat, -71.5288 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Carriage Place Pond Dam<br>Location—42.8172 lat, -71.5569 long<br>Hazard Class—NM<br>Water body—unnamed stream<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Fire Pond Dam<br>Location—42.85 lat, -71.5077 long<br>Hazard Class—NM<br>Water body—unnamed stream<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Standard Hardware Dam<br>Location—42.830585 lat, -71.49751 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C & I Investment Pond<br>Location—42.82894 lat, -71.487679 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Peaslee Place I<br>Location—42.8261 lat, -71.5502 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Fidelity Det Basin 3<br>Location—42.8119 lat, -71.5241 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Doyle Woods Det Pond Dam<br>Location—42.8319 lat, -71.4972 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Home Depot Det Pond Dam<br>Location—42.8441 lat, -71.4941 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Wasserman Detention Pond<br>Location—42.8236 lat, -71.5338 long<br>Hazard Class—NM<br>Water body—none<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion* | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Merrimack Outlet Det 3<br>Location—42.8239 lat, -71.4994 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |
| Merrimack Outlet Det 4<br>Location—42.8278 lat, -71.4961 long<br>Hazard Class—NM<br>Water body—runoff<br>Owner—privately held | Structure valuable to flood control | | ✓ | | | n/a | ✓ | | ✓ | ✓ | |

**The field assessment protocol used to determine fluvial erosion hazard zones was only able to determine potential structural vulnerability in culverts and cannot be applied to dams.*

**Table 6.6—Hazardous Materials Facilities**

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Anheuser-Busch LLC—chemicals on site include polycyclic aromatic compounds and nitric acid. | Chemical and hazardous materials release could have impacts on public health and environmental quality. To date, no chemicals have been released by this facility. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Colt Refining Inc—chemicals on site include copper, lead, mercury, silver compounds, chromium, and nickel. | Chemical and hazardous materials release could have impacts on public health and environmental quality. 2.0 pounds of copper, 0.2 pounds of lead, and 0.1 pounds of mercury have been released into the air from this facility. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

| Facility Type and Name | Content Vulnerability | Drought | Earthquake | Extreme Temperatures | Flooding | Fluvial Erosion | Hurricane | Severe Thunderstorm | Severe Winter Weather | Tornado/Downburst | Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Circuit Technology Inc—chemicals on site include lead. | Chemical and hazardous materials release could have impacts on public health and environmental quality. To date, no chemicals have been released by this facility. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Nashua Corp—chemicals on site include toluene, styrene, butyl acetate, vinyl acetate, benzo (G,H,I) perylene, zinc compounds, and polycyclic aromatic compounds. | Chemical and hazardous materials release could have impacts on public health and environmental quality. 17,885 pounds of toluene; 1,921 pounds of styrene; 427 pounds of butyl acrylate; and 137 pounds of vinyl have been released into the air from this facility. | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| JCI Jones Chemicals Inc—chemicals on site include chlorine, sodium hydroxide (in rail cars). | Chemical and hazardous materials release could have impacts on public health and environmental quality. To date, no chemicals have been released by this facility. Located in 0.2% annual floodplain. | | ✓ | | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—Saint Gobain | Hazardous materials present | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Industrial—Nanocomp | Hazardous materials present | | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ |

**Merrimack Critical Facilities Map**

## Section 3.5 ~ Vulnerability by Hazard

**Drought**

Hydrological drought is evidenced by extended periods of negative departures from normal rainfall. New Hampshire has been under several drought warnings, including a drought emergency, since 1999. The most severe drought conditions occurred between 1960 and 1969; the event had a greater than 25 year recurrence interval. The southern New Hampshire region experienced a 100-year drought event from 1964 to 1965.

Although drought is not likely to damage structures, low water levels can have a negative impact on existing and future home sites, especially those that depend on groundwater for water needs. Additionally, the dry conditions of a drought may lead to an increase wild fire risk. Drought can cause the most significant impact to agricultural land and assets.

Because the impacts of drought are long lasting and wide ranging, it is beyond the scope of this Plan to estimate the dollar value of losses to Merrimack resulting from drought. Instead, the Hazard Mitigation Team estimated the percentage of land in Merrimack vulnerable to drought as a quantitative measure of this hazard's impact. Since there is no significant agricultural land in Merrimack, no lands are particularly vulnerable to drought.

| Total Acres of Land in Merrimack | Total Acres of Agricultural Land in Merrimack | % of Land in Merrimack Vulnerable to Drought |
|---|---|---|
| 20,800 | 0 | 0% |

| Critical Facility Type | Total Number of this type of Critical Facilities in Merrimack | Number of this type of Critical Facilities in Drought Hazard Area | Percentage of this type of Critical Facilities in Drought Hazard Area |
|---|---|---|---|
| General Occupancy | 45 | 8 | 17.8% |
| Essential Facilities | 17 | 0 | 0% |
| Transportation | 23 | 0 | 0% |
| Utility System | 39 | 9 | 23.1% |
| High Potential Hazard | 19 | 0 | 0% |
| Hazardous Materials | 7 | 0 | 0% |

**Earthquake**

The Richter magnitude scale was developed by Charles F. Richter in 1935 as a way to compare the size of earthquakes. The magnitude of an earthquake is calculated from the logarithm of the amplitude of waves recorded by seismographs.

- Magnitude <2.0—micro-earthquakes. Recorded by seismographs, but not felt or rarely felt by people. Several million occur annually worldwide on average.
- Magnitude 2.0-2.9—felt slightly by some people. No damage to buildings. Over 1 million occur annually worldwide on average.

- Magnitude 3.0-3.9—often felt by people but very rarely cause damage. Shaking of indoor objects can be noticeable. Over 100,000 occur annually worldwide on average.
- Magnitude 4.0-4.9—noticeable shaking of indoor objects and rattling noises. Felt by most people in affected area. Generally causes minimal to no damage. Moderate to significant damage is very unlikely. 10,000-15,000 occur annually worldwide on average.
- Magnitude 5.0-5.9—felt by everyone. Can cause damage of varying severity to poorly constructed buildings; slight to no damage to all other buildings. Few, if any, casualties. 1,000-1,500 occur annually worldwide on average.
- Magnitude 6.0-6.9—felt up to hundreds of miles from epicenter. Strong to violent shaking in epicenter. Damage to many buildings in populated areas. Poorly designed structures have moderate to severe damage. Earthquake-resistant structures have slight to moderate damage. Damage can be caused far from epicenter. Death toll up to 25,000. 100-150 occur annually worldwide on average.
- Magnitude 7.0-7.9—felt in very large area. Damage to most buildings, including partial or complete collapse. Death toll up to 250,000. 10-20 occur annually worldwide on average.
- Magnitude 8.0-8.9—felt in extremely large region. Major damage to buildings over large areas. Structures likely destroyed. Moderate to heavy damage to sturdy or earthquake-resistant buildings. Death toll up to 1 million. 1 occurs annually worldwide on average.
- Magnitude 9.0< —damage and shaking extends to distant locations. Near or total destruction. Severe damage and collapse to all buildings. Permanent changes in ground topography. 1 occurs every 10-50 years worldwide on average.

Since 1940, there have been 14 earthquakes centered in NH with a magnitude of 3.0 or greater and only two earthquakes with a magnitude of 5.0 or greater. There have been no recorded earthquakes to-date centered in Merrimack, however, one could occur.

**Earthquake Hazard Loss Estimate**

Step 1. Determine potential earthquake strength in Merrimack

- US Seismic Hazard, 2% in 50 years PGA is 0.12 to 0.14(g) in Merrimack
- *Source: USGS NH Seismic Map*

Step 2. Determine percent building damage ratio to single family residence from PGA (g) 0.15 earthquake

- Wood Frame Construction with Low general seismic design level = 1.3% building damage
- *Source: FEMA Identifying Hazards and Estimating Losses, pg 4-17*

Step 3. Determine percent of structures in Merrimack that would be damaged by PGA (g) 0.15 earthquake

- 5% of structures estimated to be damaged by earthquake
- *Source: Merrimack Hazard Mitigation Team (no historical data on earthquake damage in Merrimack)*

Step 4. Determine total assessed value of structures in Merrimack

- Total Assessed Value of all Structures in Merrimack = $3,186,206,500

- *Source: Merrimack Assessing Department (2014)*

Step 5. Determine total loss from PGA (g) 0.15 Earthquake

- Total Loss from Earthquake = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Earthquake = $3,186,206,500 * .05 * .013 = **$2,071,034.23**

| Critical Facility Type | Total Number of this type of Critical Facilities in Merrimack | Number of this type of Critical Facilities in Earthquake Hazard Area | Percentage of this type of Critical Facilities in Earthquake Hazard Area |
|---|---|---|---|
| General Occupancy | 45 | 38 | 84.4% |
| Essential Facilities | 17 | 17 | 100% |
| Transportation | 23 | 23 | 100% |
| Utility System | 39 | 33 | 84.6% |
| High Potential Hazard | 19 | 19 | 100% |
| Hazardous Materials | 7 | 7 | 100% |

**Extreme Temperatures**

Extreme temperatures can be broken into both extreme heat and extreme cold. Though the hazards are different, the effects would be similar to vulnerable populations in Merrimack.

Extreme heat is defined as a period of three consecutive days during which the air temperature reaches 90 degrees Fahrenheit or higher on each day. Extreme heat should not be confused with a drought (extended periods of negative departures from normal rainfall). Overburdened power networks may experience failures due to the impacts of extreme heat.

Extreme cold has no formal definition in New Hampshire, though can be explained as the extended exposure to typical winter temperatures without heat and shelter. With the rising costs of heating fuel and electric heat, many low-income or homeless citizens are not able to adequately heat their homes, exposing themselves to cold related emergencies or death. Extremely cold winters can lead to shortages in heating fuels due to high demand.

Though the entire Merrimack population may experience a thermal emergency, populations without adequate climate control are most at risk. Extreme temperatures are not likely to cause damage to structures, although pipes can burst in extreme cold conditions.

**Flooding**

*Localized Flooding*

Localized flooding can result from even minor storms. Runoff overloads the drainage ways and flows into the streets and low-lying areas. Homes and businesses can be inundated, especially basements and the lower part of first floors. Localized flooding poses most of the same problems caused by larger floods, but because it typically has an impact on fewer people and affects small areas, it tends to bring

less State or Federal involvement such as funding, technical help, or disaster assistance. As a result, the community and the affected residents or business owners are left to cope with the problems on their own. Finally, flooding of this type tends to recur; small impacts accumulated over time can become major problems.

*Riverine Flooding*

Riverine flooding involves the overflowing of normal flood channels, rivers or streams, generally as a result of prolonged rainfall or rapid thawing of snow cover. The lateral spread of floodwater is largely a function of the terrain, becoming greater in wide, flat areas, and affecting narrower areas in steep terrain. In the latter cases, riparian hillsides in combination with steep declines in riverbed elevation often force waters downstream rapidly, sometimes resulting in flash floods.

Floodplains in Merrimack are widest and most extensive adjacent to the Souhegan River and Beaver Brook. Narrower floodplains lie adjacent to Witches Spring Brook, the unnamed stream south of Baboosic Lake, Baboosic Lake, Pulpit Brook, and Joe English Brook extending northeast to Damon Pond and southwest to Lincoln Pond. Many of these floodplains encompass large wetlands areas. Floodplains cover approximately 15% of Merrimack; 11.4% of the Town is within the 1% Annual Floodplain and 3.6% of the Town is within the 0.2% Annual Floodplain.

*Dam Failure*

The NH Department of Environmental Services indicates several failure modes for dams. Most typical include hydraulic failure or the uncontrolled overflowing of water, seepage, or leaking at the dam's foundation or gate; structural failure or rupture; general deterioration; and gate inoperability. These modes vary between dams depending on their construction type.

The State of New Hampshire uses a hazard potential classification based on the impact of dam breach or failure. All class S (Significant) and H (High hazard) dams have the potential to cause damage if they breach or fail. Merrimack has 16 Class NM dams (Non-Menace), 3 Class L dams (Low hazard potential), 0 Class S dams (Significant hazard potential), and 0 Class H dams (High hazard potential). Merrimack could also be impacted by dam breaches in Milford, NH. There have been no known dam breaches to-date in Merrimack.

**Flood Hazard Loss Estimate**

Step 1. Determine percent building damage to a 1 or 2 story building with basement

- 1 foot flood depth = 15% building damage
- 2 foot flood depth = 20% building damage
- 3 foot flood depth = 23% building damage
- 4 foot flood depth = 28% building damage
- *Source: FEMA Identifying Hazards and Estimating Losses, pg 4-13*

Step 2. Determine number of buildings in Merrimack located in the floodplain

- 370 buildings located in floodplain
- *Source: Merrimack Assessing Department*

Step 3. Determine total value of buildings in Merrimack located in floodplain

- Average assessed value of all structures in Merrimack = $319,868.14
- Total number of buildings in Merrimack located in floodplain = 370
- Total assessed value of all buildings in Merrimack in floodplain = $319,868.14 * 370
- Total assessed value of all buildings in Merrimack in floodplain = $118,351,211.80
- *Source: Merrimack Hazard Mitigation Team calculations based on Merrimack Assessing data*

Step 4. Determine total loss from flooding

- Total Loss from Flooding = Total Assessed Value of all Buildings in Floodplain * Percent Building Damage Ratio
- Total Loss from 1 foot flood depth = $118,351,211.80 * .15 = **$17,752,681.77**
- Total Loss from 2 foot flood depth = $118,351,211.80 * .20 = **$23,670,242.36**
- Total Loss from 3 foot flood depth = $118,351,211.80 * .23 = **$27,220,778.71**
- Total Loss from 4 foot flood depth = $118,351,211.80 * .28 = **$33,138,339.30**

| Critical Facility Type | Total Number of this type of Critical Facilities in Merrimack | Number of this type of Critical Facilities in 1% Annual Floodplain | Percentage of this type of Critical Facilities in 1% Annual Floodplain | Number of this type of Critical Facilities in 0.2% Annual Floodplain | Percentage of this type of Critical Facilities in 0.2% Annual Floodplain |
|---|---|---|---|---|---|
| General Occupancy | 45 | 4 | 8.9% | 4 | 8.9% |
| Essential Facilities | 17 | 0 | 0% | 2 | 11.8% |
| Transportation | 23 | 12 | 52.2% | 1 | 4.3% |
| Utility System | 39 | 6 | 15.4% | 7 | 17.9% |
| High Potential Hazard | 19 | 2 | 10.5% | 1 | 5.3% |
| Hazardous Materials | 7 | 0 | 0% | 1 | 14.3% |

**Fluvial Erosion**

Fluvial (river-related) erosion is the wearing away of river beds and banks by the action of running water. Fluvial erosion is a natural process and is most active during flood events. It can result in significant changes to the physical location and dimensions of river and stream channels.

New Hampshire has more than 16,000 miles of rivers and streams. Communities have historically developed along these waterways, placing infrastructure and property in hazard prone areas. Riverine flooding is the most common disaster event in NH. In recent years, some areas of the State have experienced multiple disastrous flood events at recurrence intervals of less than 10 years. On October

3, 2008 Hillsborough and Merrimack Counties experienced severe storms and flooding that led to a Presidential Disaster Declaration and $1,050,147 in damages.

Transportation infrastructure and agricultural property are typically the most vulnerable to fluvial erosion hazards. Fluvial erosion events frequently cause culverts failures, undermine bridges and roads, and wash away stream banks. Residential, commercial, and municipal properties as well as utility infrastructure can also be impacted.

The New Hampshire Department of Environmental Services (DES) and New Hampshire Geological Survey (NHGS) conducted an assessment to identify areas prone to river and stream erosion that could impact public health and safety. The assessment was conducted over the summer and fall of 2013 in the Souhegan and Piscataquog River watersheds. A private firm that specializes in the science of fluvial geomorphology, Field Geology Services, was contracted to conduct the field work. They assessed river and stream reaches using field surveys, topographical maps, aerial photos, and historic archives. Within the Souhegan Watershed, assessments were conducted on segments of the Souhegan River main stem, Baboosic Brook, Beaver Brook, Blood Brook, Great Brook, Hartshorn Brook, Stoney Brook, and Tucker Brook. Only a small section of the Piscataquog River Watershed falls within the Nashua Region and the only reach that was assessed in this area was the South Branch Piscataquog River in Lyndeborough.

Fluvial Erosion Hazard Zone maps provide an important tool for planners, emergency management personnel, and municipal officials. They can be used to identify opportunities for bridge and culvert upgrades, stream and floodplain restoration projects, and areas where development may want to be avoided. The Nashua Regional Planning Commission has incorporated the Fluvial Erosion Hazard data generated by this study into the Town's 2014 Hazard Mitigation Plan Update. Specific mitigation actions that can address public safety and fluvial erosion hazards include:

Map & Assess Vulnerability to Erosion

- Conduct stream assessments and prepare fluvial erosion hazard zone maps
- Develop and maintain a database to track community vulnerability to erosion
- Use GIS to identify concentrations of at-risk structures and infrastructure

Structure and Infrastructure Projects

- Ensure adequate stormwater drainage
- Reduce encroachment of roads, bridges, and culverts into stream channels and flood prone areas
- Ensure culverts and bridges are adequately sized and properly aligned and graded
- Consider relocating at-risk buildings and infrastructure

Help Citizens and Emergency Management Officials become More Aware of Erosion Risks

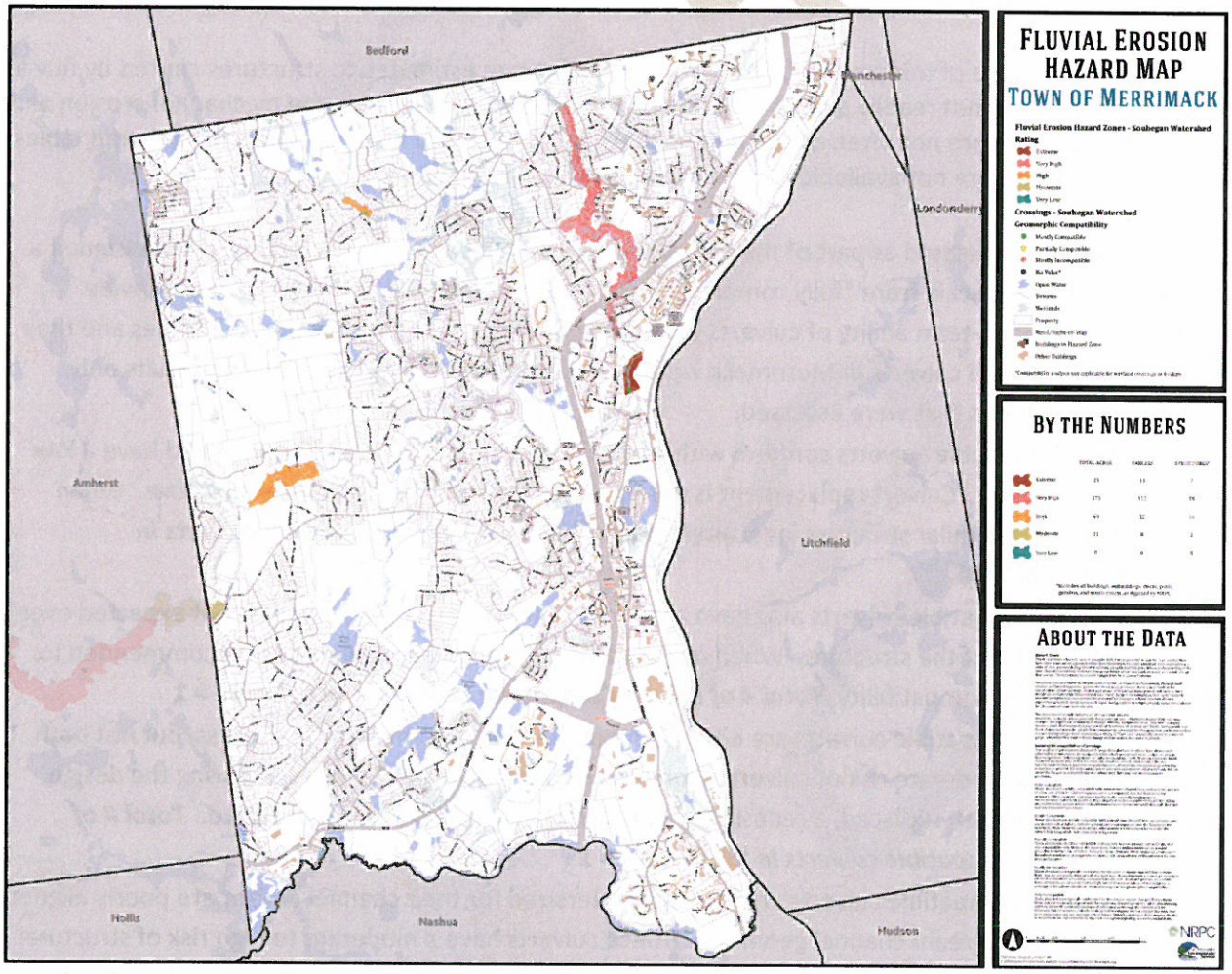
- Notify property owners in high-risk areas
- Develop outreach materials describing erosion risks and potential mitigation techniques

- Offer GIS erosion hazard mapping online

Consider Fluvial Erosion Hazard Areas in Land Use Policy

- Adopt sediment and erosion control regulations
- Consider establishing fluvial erosion hazard overlay districts
- Develop and implement an erosion management plan
- Locate utilities and critical facilities outside of areas susceptible to erosion
- Provide rivers and streams the area they need to maintain or re-establish their natural equilibrium in order to minimize erosion hazards, protect public safety and welfare, and decrease property damage and loss.

**Map 2—Fluvial Erosion Hazard Zones in Merrimack**




Fluvial Erosion Hazard (FEH) zones attempt to identify lands most vulnerable to fluvial erosion. Each river reach assessed through this project was assigned a sensitivity rating. Sensitivity is defined as the potential of a river to respond to flood events, through bank erosion and migration across the floodplain. A number of factors contribute to sensitivity, including channel straightening, development and armoring (ex. riprap) along banks, and existing erosion. Extreme sensitivity generally means a

reach is experiencing considerable erosion of its beds and banks. It typically has flood chutes and meander cutoffs that maximize potential for changing flow paths and further erosion during a large flood. Very Low sensitivity means that a reach's flow path will not change on a significant time scale.

**Fluvial Erosion Hazard Zones in Merrimack**

| Sensitivity Rating | Total Acres | Parcels | Structures* |
|---|---|---|---|
| Extreme | 23 | 13 | 7 |
| Very High | 173 | 112 | 59 |
| High | 69 | 32 | 14 |
| Moderate | 11 | 8 | 2 |
| Very Low | 0 | 0 | 0 |

*Includes all buildings, outbuildings, decks, pools, gazebos, and tennis courts as digitized by Nashua Regional Planning Commission

It is beyond the scope of this project to assign potential damage estimates to structures caused by fluvial erosion. This data is not readily available because specific flood damages caused by channel erosion and migration processes are not often documented. In addition, standard loss estimation models and tables for erosion damage are not available (*Understanding Your Risks*, FEMA, pg 4-30).

Culverts were also assessed as part of the Fluvial Erosion Hazard study and each culvert was assigned a score ranking it on a scale from "fully compatible" to "fully incompatible." These rankings provide guidance on the long-term ability of culverts to handle flow and sediment transport processes and their risk of failure. Not all culverts in Merrimack were assessed in this study. The following results only include those culverts that were assessed.

- Fully Compatible culverts conform with natural river channel form and process and have a low risk of failure. Culvert replacement is not expected over the lifetime of the structure. When replaced, a similar structure is recommended. ***Total # of Fully Compatible culverts in Merrimack* = 0**
- Mostly Compatible culverts also have a low risk of failure and replacement is not expected over the lifetime of the structure. When replaced, minor design adjustments are recommended to achieve full compatibility. ***Total # of Mostly Compatible culverts in Merrimack* = 1**
- Partially Compatible culverts are either compatible with current form or process, but not both. There is a moderate risk of culvert failure and replacement may be needed during the design lifetime. When replaced, a redesign of the culvert installation is recommended. ***Total # of Partially Compatible culverts in Merrimack* = 1**
- Mostly Incompatible culverts are typically undersized for their channel and/or are poorly aligned with the upstream channel geometry. These culverts have a moderate to high risk of structural failure and should be redesigned when replaced to improve compatibility. ***Total # of Mostly Incompatible culverts in Merrimack* = 1**
- Fully Incompatible culverts are typically undersized for their channel and/or are poorly aligned with the upstream channel geometry. They also have reduced passage of sediment through the culvert and an increased risk of erosion. These culverts have a high risk of failure and should be

prioritized for replacement with more compatible structures. ***Total # of Fully Incompatible culverts in Merrimack = 0***

A complete table of all the culverts assessed in Merrimack, including location information and compatibility ratings, appears in the Appendix to this Plan.

**Hurricane/Tropical Storm**

The Atlantic hurricane season lasts from June 1 through November 30 and peaks in late August and September. The Saffir-Simpson Hurricane Wind Scale categorizes hurricanes from 1 to 5 based on sustained wind speed. The National Weather Service National Hurricane Center provides the following estimates of potential property damage based on hurricane wind speed (http://www.nhc.noaa.gov/aboutsshws.php).

Category 1—sustained winds 74-95 mph. Very dangerous winds will produce some damage. Well-constructed frame homes could have damage to roof, shingles, vinyl siding, and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.

Category 2—sustained winds 96-110 mph. Extremely dangerous winds will cause extensive damage. Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.

Category 3—sustained winds 111-129 mph. Devastating damage will occur. Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.

Category 4—sustained winds 130-156 mph. Catastrophic damage will occur. Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Category 5—sustained winds 157 mph or higher. Catastrophic damage will occur. A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possible months. Most of the area will be uninhabitable for weeks or months.

FEMA declared disasters in Hillsborough County during Hurricane Bob (1991) and Hurricane Floyd (1999). Though these were the only formally declared incidents, Merrimack has experienced strong remnants of numerous tropical cyclones including Hurricane Carol (1954), Donna (1960), Gloria (1985), Irene (2011), and Sandy (2012).

**Hurricane Hazard Loss Estimate**

There are no standard loss estimation models or tables for wind damage (*Understanding Your Risks,* FEMA, pg 4-30). As such, the Hazard Mitigation Team used data from previous hurricane events to determine damage estimates. Historically, the strongest hurricane seen in NH was a Category 3, so loss estimates were calculated based on a hurricane of that strength. Hurricanes have primarily damaged road networks and infrastructure in NH. It is beyond the scope of this project to estimate the costs of repairing or replacing transportation and utility infrastructure damaged by a hurricane. The Hazard Mitigation Team used the following calculations to estimate loss to single family residential structures from a hurricane.

Step 1. Determine percent building damage ratio to single family residence from Category 3 hurricane

- Wood Frame Construction, Low general hurricane design level = 20% building damage
- *Source: Merrimack Hazard Mitigation Team*

Step 2. Determine percent of structures in Merrimack that would be damaged by Category 3 hurricane

- 5% of structures estimated to be damaged by Category 3 hurricane
- *Source: Merrimack Hazard Mitigation Team (no historical data on hurricane damage in Merrimack)*

Step 3. Determine total assessed value of structures in Merrimack

- Total Assessed Value of all Structures in Merrimack = $3,186,206,500
- *Source: Merrimack Assessing Department (2014)*

Step 4. Determine total loss from Category 3 hurricane

- Total Loss from Hurricane = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Hurricane = $3,186,206,500 * .05 * .2 = **$31,862,065**

| Critical Facility Type | Total Number of this type of Critical Facilities in Merrimack | Number of this type of Critical Facilities in Hurricane Hazard Area | Percentage of this type of Critical Facilities in Hurricane Hazard Area |
|---|---|---|---|
| General Occupancy | 45 | 38 | 84.4% |
| Essential Facilities | 17 | 17 | 100% |
| Transportation | 23 | 23 | 100% |
| Utility System | 39 | 33 | 84.6% |
| High Potential Hazard | 19 | 19 | 100% |
| Hazardous Materials | 7 | 7 | 100% |

**Severe Thunderstorm**

Severe thunderstorms typically contain heavy rainfall, high winds, and lightning. In extreme cases, thunderstorms have the potential to create tornadoes and downbursts. While thunderstorms are a common occurrence during the summer, not all thunderstorms create damage or injure humans.

Severe thunderstorms can create heavy rainfall, which may result in localized flooding. While thunderstorm tracking has become more accurate, severe thunderstorms typically result in very little warning and the aftermath of their rain and wind is extremely difficult to estimate.

By definition, all thunderstorms contain lightning. Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through the air, it heats the air to a temperature of about 50,000 degrees Fahrenheit, considerably hotter than the surface of the Sun. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to ambient temperatures. This rapid expansion and contraction causes a shock wave that we hear as thunder.

Lightning is a major hazard to citizens involved in outdoor activities. A lightning strike at a densely attended special event has the potential to create a major mass casualty incident. Lightning also can create wildfires and structure fires and may cause power and/or communications outages.

**Severe Thunderstorm Hazard Loss Estimate**

Losses from severe thunderstorms would be similar to those sustained by hurricanes, only on a smaller, more localized scale. The Hazard Mitigation Team used the following calculations to estimate loss to single family residential structures from a severe thunderstorm.

Step 1. Determine percent building damage ratio to single family residence from severe thunderstorm
- Wood Frame Construction, Low general hurricane design level = 5% building damage
- *Source: Merrimack Hazard Mitigation Team*

Step 2. Determine percent of structures in Merrimack that would be damaged by severe thunderstorm
- 0.5% of structures estimated to be damaged by severe thunderstorm
- *Source: Merrimack Hazard Mitigation Team (no historical data on severe thunderstorm damage in Merrimack)*

Step 3. Determine total assessed value of structures in Merrimack
- Total Assessed Value of all Structures in Merrimack = $3,186,206,500
- *Source: Merrimack Assessing Department (2014)*

Step 4. Determine total loss from severe thunderstorm
- Total Loss from Severe Thunderstorm = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Severe Thunderstorm = $3,186,206,500 * .005 * .05 = **$796,551.63**

| Critical Facility Type | Total Number of this type of Critical Facilities in Merrimack | Number of this type of Critical Facilities in Severe Thunderstorm Hazard Area | Percentage of this type of Critical Facilities in Severe Thunderstorm Hazard Area |
|---|---|---|---|
| General Occupancy | 45 | 45 | 100% |

| | | | |
|---|---|---|---|
| Essential Facilities | 17 | 17 | 100% |
| Transportation | 23 | 4 | 17.4% |
| Utility System | 39 | 30 | 76.9% |
| High Potential Hazard | 19 | 0 | 0% |
| Hazardous Materials | 7 | 7 | 100% |

**Severe Winter Weather**

A heavy snowstorm is generally considered to be one that deposits two or more inches of snow per hour in a twelve-hour period. Heavy snow can immobilize a region, stranding commuters, closing businesses, and disrupting emergency services. Accumulating snow can collapse buildings and knock down trees and power lines. Snow removal from roadways, utility damage, and disruption to businesses can have a significant economic impact on municipalities and residents.

A blizzard is a violent snowstorm with winds blowing at a minimum speed of 35 miles per hour and visibility of less than one-quarter mile for three hours. A Nor'easter is a large weather system traveling from south to north, passing along the coast. As the storm's intensity increases, the resulting counterclockwise winds impact the coast and inland areas in a Northeasterly direction. Winds from a Nor'easter can meet or exceed hurricane force, knocking down trees, utility poles, and power lines.

Ice storms occur when a mass of warm, moist air collides with a mass of cold, arctic air. The less dense warm air rises and the moisture precipitates out in the form of rain. When this rain falls through the colder, more-dense air and comes in contact with cold surfaces, ice forms and can become several inches thick. Heavy accumulations of ice can knock down trees, power lines, and communications for extended periods of time.

In recent years, FEMA issued disaster declarations in Hillsborough County for severe winter weather in 1998, 2008, 2010, 2011, and 2013. Among these storms was a rare Nor'easter in late October of 2011 that caused major destruction in Hillsborough and Rockingham Counties. Heavy wet snow fell on trees that had much of their foliage remaining. Many trees could not withstand the extra weight of the snow and collapsed under the stress. Damage was very focused in the southern part of New Hampshire and caused nearly three times the amount of debris that the 2008 ice storm produced.

**Severe Winter Weather Hazard Loss Estimate**

Severe Winter Weather events have primarily damaged road networks and infrastructure in NH. It is beyond the scope of this project to estimate the costs of repairing or replacing transportation and utility infrastructure damaged by severe winter weather. The Hazard Mitigation Team used the following calculations to estimate loss to single family residential structures from severe winter weather.

Step 1. Determine percent building damage ratio to single family residence from severe winter weather

- Wood Frame Construction, no additional provisions for roof snow loads = 5% building damage
- *Source: Merrimack Hazard Mitigation Team*

Step 2. Determine percent of structures in Merrimack that would be damaged by severe winter weather

- 1% of structures estimated to be damaged by severe winter weather
- *Source: Merrimack Hazard Mitigation Team*

Step 3. Determine total assessed value of structures in Merrimack
- Total Assessed Value of all Structures in Merrimack = $3,186,206,500
- *Source: Merrimack Assessing Department (2014)*

Step 4. Determine total loss from Severe Winter Weather
- Total Loss from Severe Winter Weather = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Severe Winter Weather = $3,186,206,500 * .01 * .05 = **$1,593,103.25**

| Critical Facility Type | Total Number of this type of Critical Facilities in Merrimack | Number of this type of Critical Facilities in Severe Winter Weather Hazard Area | Percentage of this type of Critical Facilities in Severe Winter Weather Hazard Area |
|---|---|---|---|
| General Occupancy | 45 | 38 | 84.4% |
| Essential Facilities | 17 | 17 | 100% |
| Transportation | 23 | 23 | 100% |
| Utility System | 39 | 12 | 30.8% |
| High Potential Hazard | 19 | 19 | 100% |
| Hazardous Materials | 7 | 7 | 100% |

**Tornado/Downburst**

A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of 1 mile wide and 50 miles long. Tornadoes are created when cold air overrides warm air, causing the warm air to rise rapidly.

A downburst is a severe localized wind blasting down from a thunderstorm. These 'straight line' winds are distinguishable from tornadic activity by their pattern of destruction and debris. Depending on the size and location of these events, the destruction to property may be devastating. Downbursts fall into two categories. Microbursts cover an area less than 2.5 miles in diameter and macrobursts cover an area at least 2.5 miles in diameter.

Hillsborough County has a higher risk of tornado activity compared to the rest of the State. Between 1961 and 1998 there were 15 known tornadoes in Hillsborough County. The most recent downburst activity occurred on July 6, 1999 in the form of a macroburst in Merrimack, Grafton and Hillsborough Counties. There were two fatalities as well as roof damage, widespread power outages, and downed trees, utility poles and wires.

**Tornado Hazard Loss Estimate**

There are no standard loss estimation models or tables for tornados (*Understanding Your Risks,* FEMA, pg 4-27). As such, the Hazard Mitigation Team used data from previous tornado events to determine

damage estimates. Historically, the strongest tornado seen in Hillsborough County was a F2, so loss estimates were calculated based on a tornado of that strength.

Step 1. Determine percent building damage ratio to single family residence from F2 tornado

- Wood Frame Construction, Low general tornado design level = 50% building damage
- *Source: Merrimack Hazard Mitigation Team*

Step 2. Determine percent of structures in Merrimack that would be damaged by F2 tornado

- 1% of structures estimated to be damaged by F2 tornado
- *Source: Merrimack Hazard Mitigation Team (no historical data on tornado damage in Merrimack)*

Step 3. Determine total assessed value of structures in Merrimack

- Total Assessed Value of all Structures in Merrimack = $3,186,206,500
- *Source: Merrimack Assessing Department (2014)*

Step 4. Determine total loss from F2 Tornado

- Total Loss from Tornado = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Tornado = $3,186,206,500 * .01 * .5 = **$15,931,032.50**

| Critical Facility Type | Total Number of this type of Critical Facilities in Merrimack | Number of this type of Critical Facilities in Tornado Hazard Area | Percentage of this type of Critical Facilities in Tornado Hazard Area |
|---|---|---|---|
| General Occupancy | 45 | 38 | 84.4% |
| Essential Facilities | 17 | 17 | 100% |
| Transportation | 23 | 23 | 100% |
| Utility System | 39 | 17 | 43.6% |
| High Potential Hazard | 19 | 19 | 100% |
| Hazardous Materials | 7 | 7 | 100% |

**Wildfire**

Wildfires are fires ignited in grassy or wooded areas. They may be ignited intentionally by humans, naturally through lightning, or accidentally due to spark ignition from sources such as power lines or fireworks. The interface between forested lands and developed lands poses an ongoing threat to property from wildfires. Potential wildfire areas outside of the recommended response time radius from the fire station may pose a higher risk to structures and residents than those located closer to the fire station.

Wildfire hazard losses are dependent on a number of factors, including access to parcels, lot size, proximity to forested lands, topography, building materials, and proximity to fire protection water source.

**Wildfire Hazard Loss Estimate**

Step 1. Determine percent building damage ratio to single family residence from wildfire

- Wood Frame Construction, combustible siding and decking = 20% building damage
- *Source: Merrimack Hazard Mitigation Team*

Step 2. Determine percent of structures in Merrimack that would be damaged by wildfire

- 0.5% of structures estimated to be damaged by wildfire
- *Source: Merrimack Hazard Mitigation Team*

Step 3. Determine total assessed value of structures in Merrimack

- Total Assessed Value of all Structures in Merrimack = $3,186,206,500
- *Source: Merrimack Assessing Department (2014)*

Step 4. Determine total loss from Wildfire

- Total Loss from Wildfire = Total Assessed Value of all Structures *Percentage of Structures Estimated to be Damaged * Percent Building Damage Ratio
- Total Loss from Wildfire = $3,186,206,500 * .005 * .2 = **$3,186,206.50**

| Critical Facility Type | Total Number of this type of Critical Facilities in Merrimack | Number of this type of Critical Facilities in Wildfire Hazard Area | Percentage of this type of Critical Facilities in Wildfire Hazard Area |
|---|---|---|---|
| General Occupancy | 45 | 38 | 84.4% |
| Essential Facilities | 17 | 17 | 100% |
| Transportation | 23 | 1 | 4.3% |
| Utility System | 39 | 12 | 30.8% |
| High Potential Hazard | 19 | 0 | 0% |
| Hazardous Materials | 7 | 7 | 100% |

## Section 3.6 ~ Overall Summary of Vulnerability

**Table 7a—Overall Summary of Vulnerability by Hazard**

| Hazard | Types of Critical Facilities Impacted by Hazard | Impact of Hazard | % of Critical Facilities in Hazard Area | % of Structures Estimated to be Damaged | $ Value of Loss |
|---|---|---|---|---|---|
| Drought | Agricultural land.<br><br>Not likely to have a significant impact on structures. | Loss of crops.<br><br>Inadequate quantity of drinking water.<br><br>Loss of water for fire protection. | General Occupancy = 17.8%<br><br>Essential Facilities = 0%<br><br>Transportation | 0 acres of agricultural land | Calculating $ value of losses is beyond the scope of this Plan (see Section 3.5 Drought for explanation) |

| Hazard | Types of Critical Facilities Impacted by Hazard | Impact of Hazard | % of Critical Facilities in Hazard Area | % of Structures Estimated to be Damaged | $ Value of Loss |
|---|---|---|---|---|---|
| | | Increased risk of fire. | = 0%<br><br>Utility Systems = 23.1%<br><br>High Potential Hazard = 0%<br><br>Hazardous Materials = 0% | | |
| Earthquake | General Occupancy<br><br>Essential Facilities<br><br>Transportation<br><br>Utility Systems<br><br>High Potential Hazard<br><br>Hazardous Materials | Structural damage or collapse of buildings.<br><br>Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, radio system.<br><br>Loss of water for fire protection.<br><br>Risk to life, medical surge. | General Occupancy = 84.4%<br><br>Essential Facilities = 100%<br><br>Transportation = 100%<br><br>Utility Systems = 84.6%<br><br>High Potential Hazard = 100%<br><br>Hazardous Materials = 100% | 5% | $2,071,034.23 |
| Extreme Temperatures | Not likely to have a significant impact on structures. | Overburdened power networks.<br><br>Heating fuel shortages.<br><br>Risk to life from prolonged exposure. | General Occupancy = 0%<br><br>Essential Facilities = 0%<br><br>Transportation = 0%<br><br>Utility Systems = 0%<br><br>High Potential Hazard = 0%<br><br>Hazardous | 0% | $0 |

| Hazard | Types of Critical Facilities Impacted by Hazard | Impact of Hazard | % of Critical Facilities in Hazard Area | % of Structures Estimated to be Damaged | $ Value of Loss |
|---|---|---|---|---|---|
| | | | Materials = 0% | | |
| Flooding | General Occupancy<br><br>Transportation<br><br>High Potential Hazard<br><br>Hazardous Materials | Water damage to structures and their contents.<br><br>Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, radio system.<br><br>Environmental hazards resulting from damage.<br><br>Isolation of neighborhoods resulting from flooding. | General Occupancy = 8.9% in 1% annual floodplain; 8.9% in 0.2% annual floodplain<br><br>Essential Facilities = 0% in 1% annual floodplain; 11.8% in 0.2% annual floodplain<br><br>Transportation = 52.2% in 1% annual floodplain; 4.3% in 0.2% annual floodplain<br><br>Utility Systems = 15.4% in 1% annual floodplain; 17.9% in 0.2% annual floodplain<br><br>High Potential Hazard = 10.5% in 1% annual floodplain; 5.3% in 0.2% annual floodplain<br><br>Hazardous Materials = 0% in 1% annual floodplain; | Up to 370 buildings | 1 foot flood = $17,752,681.77<br><br>2 foot flood = $23,670,242.36<br><br>3 foot flood = $27,220,778.71<br><br>4 foot flood = $33,138,339.30 |

| Hazard | Types of Critical Facilities Impacted by Hazard | Impact of Hazard | % of Critical Facilities in Hazard Area | % of Structures Estimated to be Damaged | $ Value of Loss |
|---|---|---|---|---|---|
| | | | 14.3% in 0.2% annual floodplain | | |
| Fluvial Erosion | • General Occupancy<br>• Transportation Systems | Washed out culverts.<br><br>Undermined bridges and roadways.<br><br>Property loss and damage to structures located along washed out stream banks. | General Occupancy = n/a<br><br>Essential Facilities = 0%<br><br>Transportation = 21.7%<br><br>Utility Systems = n/a<br><br>High Potential Hazard = n/a<br><br>Hazardous Materials = 0% | Up to 82 structures | It is beyond the scope of this project to assign potential damage estimates to structures caused by fluvial erosion. |
| Hurricane/Tropical Storm | General Occupancy<br><br>Essential Facilities<br><br>Transportation<br><br>Utility Systems<br><br>High Potential Hazard<br><br>Hazardous Materials | Wind damage to structures and trees.<br><br>Water damage to structures and their contents.<br><br>Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, radio system.<br><br>Environmental hazards resulting from damage.<br><br>Isolation of neighborhoods resulting from | General Occupancy = 84.4%<br><br>Essential Facilities = 100%<br><br>Transportation = 100%<br><br>Utility Systems = 84.6%<br><br>High Potential Hazard = 100%<br><br>Hazardous Materials = 100% | 5% | $31,862,065 |

| Hazard | Types of Critical Facilities Impacted by Hazard | Impact of Hazard | % of Critical Facilities in Hazard Area | % of Structures Estimated to be Damaged | $ Value of Loss |
|---|---|---|---|---|---|
| | | flooding. | | | |
| Severe Thunderstorm | General Occupancy<br><br>Essential Facilities<br><br>Utility System<br><br>High Potential Hazard<br><br>Hazardous Materials | Smoke and fire damage to structures.<br><br>Disruption to power lines and municipal communications.<br><br>Damage to critical electronic equipment.<br><br>Injury or death to people involved in outdoor activity. | General Occupancy = 100%<br><br>Essential Facilities = 100%<br><br>Transportation = 17.4%<br><br>Utility Systems = 76.9%<br><br>High Potential Hazard = 0%<br><br>Hazardous Materials = 100% | 0.5% | $796,551.63 |
| Severe Winter Weather | General Occupancy<br><br>Essential Facilities<br><br>Transportation<br><br>Utility<br><br>High Potential Hazard<br><br>Hazardous Materials | Disruption to road network.<br><br>Damage to trees and power lines, communications.<br><br>Structural damage to roofs/collapse.<br><br>Increase in CO, other hazards. | General Occupancy = 84.4%<br><br>Essential Facilities = 100%<br><br>Transportation = 100%<br><br>Utility Systems = 30.8%<br><br>High Potential Hazard = 100%<br><br>Hazardous Materials = 100% | 1% | $1,593,103.25 |
| Tornado/Downburst | General Occupancy<br><br>Essential Facilities<br><br>Transportation | Wind damage to structures and trees.<br><br>Damage or loss of infrastructure, | General Occupancy = 84.4%<br><br>Essential Facilities = | 1% | $15,931,032.50 |

| Hazard | Types of Critical Facilities Impacted by Hazard | Impact of Hazard | % of Critical Facilities in Hazard Area | % of Structures Estimated to be Damaged | $ Value of Loss |
|---|---|---|---|---|---|
| | Utility System<br><br>High Potential Hazard<br><br>Hazardous Materials | including roads, bridges, railroads, power and phone lines, municipal communications, radio system.<br><br>Environmental hazards resulting from damage.<br><br>Medical surge. | 100%<br><br>Transportation = 100%<br><br>Utility Systems = 43.6%<br><br>High Potential Hazard = 100%<br><br>Hazardous Materials = 100% | | |
| Wildfire | General Occupancy<br><br>Essential Facilities<br><br>Utility System<br><br>High Potential Hazard<br><br>Hazardous Materials | Smoke and fire damage to structures in wild land/urban interface.<br><br>Damage to habitat.<br><br>Impacts to air quality.<br><br>Loss of natural resources. | General Occupancy = 84.4%<br><br>Essential Facilities = 100%<br><br>Transportation = 4.3%<br><br>Utility Systems = 30.8%<br><br>High Potential Hazard = 0%<br><br>Hazardous Materials = 100% | 0.5% | $3,186,206.50 |

**Table 7b—Overall Summary of Vulnerability by Facility Type**

| Facility Type | Total # of facilities | # susceptible to Drought | # susceptible to Earthquake | # susceptible to Extreme Temperatures | # susceptible to Flooding | # susceptible to Fluvial Erosion | # susceptible to Hurricane | # susceptible to Severe Thunderstorm | # susceptible to Severe Winter Weather | # susceptible to Tornado/Downburst | # susceptible to Wildfire |
|---|---|---|---|---|---|---|---|---|---|---|---|
| General Occupancy | 45 | 8 | 38 | 0 | 4 in 1% annual, 4 in 0.2% annual | n/a | 38 | 45 | 38 | 38 | 38 |
| Essential Facilities | 17 | 0 | 17 | 0 | 0 in 1% annual; 2 in 0.2% annual | 0 | 17 | 17 | 17 | 17 | 17 |
| Transportation | 23 | 0 | 23 | 0 | 12 in 1% annual; 1 in 0.2% annual | 5 | 23 | 4 | 23 | 23 | 1 |
| Utility | 39 | 9 | 33 | 0 | 6 in 1% annual; 7 in 0.2% annual | n/a | 33 | 30 | 12 | 17 | 12 |
| High Hazard | 19 | 0 | 19 | 0 | 2 in 1% annual; 1 in 0.2% annual | n/a | 19 | 0 | 19 | 19 | 0 |
| Hazardous Materials | 7 | 0 | 7 | 0 | 0 in 1% annual; 1 in 0.2% annual | 0 | 7 | 7 | 7 | 7 | 7 |

## Section 3.7 ~ National Flood Insurance Program

The Town of Merrimack participates in the National Flood Insurance Program (NFIP). This provides full insurance coverage based on risk as shown on detailed Flood Insurance Rate Maps (FIRMs). Merrimack joined the NFIP on July 16, 1979. The Town's initial Flood Hazard Boundary Map was identified on April 12, 1974 and its initial Flood Insurance Rate Map was identified on July 16, 1979. The current effective map date is September 25, 2009.

Merrimack has 95 NFIP policies in force and $22,316,200 of insurance in force. There have been 51 paid losses totaling $1,205,852. Merrimack has 8 repetitive loss properties with repetitive loss payments totaling $818,835.

As a participant in the NFIP, communities must agree to adopt a floodplain management ordinance and enforce the regulations found in the ordinance. Merrimack has adopted the "Flood Hazard Conservation District," found in Section 2.02.8 of the Merrimack Zoning Ordinance and Building Code. The Flood Hazard Conservation District is determined to be the flood hazard areas designated by the Federal Insurance Administration, through on-site mapping of elevations in the flood hazard areas of the Town of Merrimack, dated September 25, 2008. The Flood Hazard Conservation District is shown in the Flood Insurance Study and on the Flood Insurance Rate Maps of Hillsborough County, NH. In all cases where the Flood Hazard Conservation District is super-imposed over another zoning district in the Town, the district whose regulations are the more restrictive shall apply.

The purpose of the Flood Hazard Conservation District is:

- To prevent unwise use of lands susceptible to flooding within Special Flood Hazard Areas; to promote sound orderly development of the Town's resources; and to reduce future flood damage, financial loss, suffering, and loss of life.
- To prevent the development of residential, commercial, and industrial buildings and other land uses in Special Flood Hazard Areas, which would impede the natural water flow or result in an increase in flood levels during flood periods.
- To prevent the destruction and inappropriate use of flood-prone land.
- To prevent unnecessary or excessive expenses on the part of the Town to provide and maintain essential services and utilities which arise because of inharmonious use of lands within Special Flood Hazard Area.
- To prevent culverting, damming, dredging or obstructing such as to impede or obstruct natural water flow during its maximum flood level.
- To prevent the building of public facilities such as schools, hospitals, fire, police departments, or other similarly related agencies except those necessary for the public health, safety, and welfare, whereupon such uses shall otherwise remain in full conformance with applicable Federal requirements.

To demonstrate the Merrimack's continued compliance with NFIP requirements, the Hazard Mitigation Team identified the follow mitigation actions as part of its comprehensive mitigation strategy. These actions also appear in Section 4.2, Table 9—Mitigation Actions.

**Table 8—National Flood Insurance Program Mitigation Actions**

| National Flood Insurance Program Mitigation Actions | | | |
|---|---|---|---|
| **Mitigation Action** | **Mitigation Type** | **Hazard Addressed** | **Critical Facilities Addressed** |
| Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event. Form partnerships between local, | • Emergency Services Protection | • Flooding<br>• Erosion<br>• Hurricane | • General Occupancy<br>• Essential Facilities<br>• Transportation Systems<br>• Utility Systems |

| | | | |
|---|---|---|---|
| state, and regional entities to expand resources and improve coordination to support floodplain management. | | | • High Potential Hazard<br>• Hazardous Materials |
| Incorporate flood mitigation into local planning. Revise/adopt subdivision regulations and erosion control regulations to improve floodplain management in Merrimack. | • Prevention<br>• Natural Resources Protection | • Flooding<br>• Erosion<br>• Hurricane | • General Occupancy<br>• Essential Facilities<br>• Transportation Systems<br>• Utility Systems<br>• High Potential Hazard<br>• Hazardous Materials |
| Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets or booklets. | • Public Information | • Flooding | • General Occupancy |

# CHAPTER 4. MITIGATION STRATEGY

## Section 4.1 ~ Goals and Objectives to Reduce Vulnerabilities to Hazards

The first step in developing a mitigation strategy is to establish goals that reflect what the municipality wishes to achieve through the implementation of its Hazard Mitigation Plan. The Merrimack Hazard Mitigation Team established the following goals and objectives, based on its desire to protect the Town's population, critical facilities, infrastructure, emergency services, natural resources, and private property. These goals provided the basis for identifying and prioritizing mitigation actions.

Goal 1—Prevent the impacts of natural hazards on the Town's population, critical facilities, infrastructure, emergency services, natural resources, and private property whenever possible.

- Objective 1.1—Manage development of known hazard areas to avoid the risks associated with natural hazards.
- Objective 1.2—Plan to incorporate hazard mitigation into capital improvements and other future initiatives.
- Objective 1.3—Ensure building codes and other standards include requirements that make new construction more disaster resistant.
- Objective 1.4—Support the maintenance of this hazard mitigation plan.

Goal 2—Protect the Town's existing critical facilities, infrastructure, and private property from the impacts of natural hazards through cost effective mitigation activities.

- Objective2.1—Modify existing structures to reduce damage from future natural hazard events.
- Objective 2.2—Perform cost effective flood hazard mitigation measures to protect private property.

Goal 3—Educate and inform the Town's residents to help them become more resilient to natural hazards impacting the community.

- Objective 3.1—Utilize educational methods to change the perception from "disaster losses are acceptable" to "many disaster losses are preventable if mitigation practices are followed."
- Objective 3.2—provide educational opportunities across all age ranges.
- Objective 3.3—Develop and distribute public awareness materials regarding the relative risk of natural hazards and practical mitigation measures to reduce damages and injuries.

Goal 4—Address the challenges of natural resource degradation and the associated increased risk from hazards.

- Objective 4.1—Ensure development in hazard areas does not destroy natural barriers to damage, such as floodplains and vegetation.
- Objective 4.2—Protect or recreate environmental assets to help safeguard the built environment.

Goal 5—Protect emergency services, critical facilities, and other critical capabilities from hazard damage in order for them to remain operational.

- Objective 5.1—Identify critical facilities, infrastructure, and emergency services and their vulnerabilities to natural hazards.
- Objective 5.2— Develop and implement programs to promote hazard mitigation actions that protect the provision of emergency services in Town.
- Objective 5.3—Identify, maintain, and protect evacuation routes from hazard damage so they are usable when needed.

## Section 4.2 ~ Mitigation Actions

After establishing goals and objectives to reduce vulnerabilities to each hazard type, the Hazard Mitigation Team identified mitigation actions to achieve these goals. The resulting mitigation actions appear in Table 9 below.

**Table 9—Mitigation Actions**

| Mitigation Action | Mitigation Type | Hazard Addressed | Critical Facilities Addressed |
|---|---|---|---|
| **National Flood Insurance Program Mitigation Actions** | | | |
| Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event. Form partnerships between local, state, and regional entities to expand resources and improve coordination to support floodplain management. | • Emergency Services Protection | Flooding<br>Erosion<br>Hurricane | • General Occupancy<br>• Essential Facilities<br>• Transportation Systems<br>• Utility Systems<br>• High Potential Hazard<br>• Hazardous Materials |
| Incorporate flood mitigation into local planning. Revise/adopt subdivision regulations and erosion control regulations to improve floodplain management in Merrimack. | • Prevention<br>• Natural Resources Protection | Flooding<br>Erosion<br>Hurricane | • General Occupancy<br>• Essential Facilities<br>• Transportation Systems<br>• Utility Systems<br>• High Potential Hazard<br>• Hazardous Materials |
| Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets or booklets. | • Public Information | • Flooding | • General Occupancy |
| **Additional Mitigation Actions** | | | |
| Require water conservation by enforcing the year round even/odd water ordinance, which limits the days outside watering is allowed based on street address and date. | • Prevention<br>• Public Education<br>• Natural Resources Protection | • Drought | • General Occupancy<br>• Utility System |
| Map and assess vulnerability to erosion. Conduct stream assessments and prepare fluvial erosion | • Prevention | • Fluvial Erosion | • General Occupancy<br>• Essential Facilities<br>• Transportation Systems<br>• Utility Systems |

| Mitigation Action | Mitigation Type | Hazard Addressed | Critical Facilities Addressed |
|---|---|---|---|
| hazard zone maps. | | | • High Potential Hazard<br>• Hazardous Materials |
| Remove structures from flood-prone areas to minimize future flood losses. | • Prevention | • Flooding | • General Occupancy<br>• Essential Facilities<br>• Utility Systems<br>• Hazardous Materials |
| Conduct regular maintenance to help drainage systems and flood control structures, including catch basin and swale cleaning. | • Prevention | • Flood<br>• Fluvial Erosion | • Transportation System |
| Elevate new roads and bridges above the base flood elevation and raise existing low-lying bridges and roads. | • Structural | • Flooding<br>• Fluvial Erosion<br>• Hurricane | • Transportation Systems |
| Protect critical communications and equipment from lightning damage by installing surge protection on critical electronic equipment and backup servers and using battery backups. | • Property Protection | • Severe Thunderstorm | • General Occupancy<br>• Essential Facilities<br>• Utility Systems<br>• Hazardous Materials |
| Protect vulnerable populations from the impacts of extreme temperatures and severe winter storms by establishing heating and cooling centers at designated facilities and providing transportation to and from these centers. | • Prevention<br>• Public Education | • Extreme Temperatures<br>• Severe Winter Weather | • Vulnerable populations |
| Enforce the International Building Code (IBC) and International Residential Code (IRC) | • Prevention<br>• Property Protection | • Earthquake<br>• Flooding<br>• Hurricanes<br>• Severe Winter Weather | • General Occupancy<br>• Essential Facilities<br>• Transportation Systems<br>• Utility Systems |

| Mitigation Action | Mitigation Type | Hazard Addressed | Critical Facilities Addressed |
|---|---|---|---|
| to protect buildings and infrastructure from the impacts of earthquakes, flooding, hurricanes, and winter storms. | | | • High Potential Hazard<br>• Hazardous Materials |
| Conduct outreach and education programs to increase awareness of earthquakes, extreme temperatures, hurricanes, severe thunderstorms, and severe winter weather. | • Public Education | • Severe Thunderstorm<br>• Severe Winter Weather<br>• Tornado<br>• Wildfire | • General Occupancy<br>• Essential Facilities<br>• Transportation Systems<br>• Utility Systems<br>• High Potential Hazard<br>• Hazardous Materials |

## Section 4.3 ~ Prioritizing Mitigation Actions

After identifying mitigation actions to address each hazard, the Team then began a two-step process to prioritize them. The first step was to conduct a benefit cost review. Benefit cost reviews provide a comprehensive overview of the monetary and non-monetary costs and benefits associated with each action. During this process, the Hazard Mitigation Team asked a variety of questions such as, "How beneficial is this action to the entire Town?" "How many people will benefit from this action?" "How large of an area is impacted by this project?" "How costly is this project?"

**Table 10—Benefit Cost Review**

| Mitigation Action | Likely Benefits | Likely Costs |
|---|---|---|
| Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event. Form partnerships between local, state, and regional entities to expand resources and improve coordination to support floodplain management. | • This action helps municipalities to share resources and decreases the burden on any one community.<br>• This action helps the Town to know what resources are available for use in an emergency.<br>• This action has the potential to reduce flood related economic losses. | • Responding to a mutual aid call in a neighboring community could take away resources from Merrimack.<br>• Mutual aid calls for non-federally declared disasters would not be reimbursed by FEMA.<br>• Percentage of $9,380 *(source: 2013-2014 Fire Department Emergency Management budget)* |
| Incorporate flood mitigation into local planning. Revise/adopt subdivision regulations and erosion control regulations to | • This action would be most beneficial to residents in flood-prone areas of Town. | • There are potential economic costs associated with limiting where development can go. |

| Mitigation Action | Likely Benefits | Likely Costs |
|---|---|---|
| improve floodplain management in Merrimack. | • This action has the potential to reduce flood related economic losses. | • Percentage of $66,604 *(source: 2013-2014 Planning/Zoning Administrator budget)* |
| Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets or booklets. | • Educate residents, builders, and other professionals about NFIP<br>• Reduce property loss costs associated with flooding | • Minimal, part of normal town operations<br>• $200 *(source: 2013-2014 Code Enforcement Clerical wages)* |
| Require water conservation by enforcing the year round even/odd water ordinance, which limits the days outside watering is allowed based on street address and date. | • If followed, it would help to reduce the impacts of drought. | • The effectiveness of this action depends on the ability of the Town to enforce it.<br>• This action is costly to enforce<br>• $4,400 Advertising & Public Information; $500 Public Education *(source: 2012-2013 Merrimack Village District budget)* |
| Map and assess vulnerability to erosion. Conduct stream assessments and prepare fluvial erosion hazard zone maps. | • This action is the first step towards avoiding and reducing future losses from erosion.<br>• This action can help determine how areas at greatest risk of erosion can be targeted for hazard mitigation opportunities. | • $0—the entire cost of this action is being borne by the NH DES through a FEMA Pre-Disaster Mitigation grant. There are no costs to the Town. |
| Remove structures from flood-prone areas to minimize future flood losses. | • This action would avoid future flood losses to the properties that are moved.<br>• Decrease in emergency response costs. | • Loss of tax revenue from the property.<br>• FEMA covers the administrative costs associated with this action.<br>• $0—no direct costs to Town, town only facilitates process |
| Conduct regular maintenance to help drainage systems and flood control structures, including catch basin and swale cleaning. | • Taking this action helps reduce the risk of major repair costs that might occur if no action were taken.<br>• There are environmental benefits to surface water quality. | • Individual culvert and storm drain maintenance may only benefit a localized area, while the economic costs are shared among the entire population.<br>• $10,000 *(source: 2013-2014 Highway Dept. Drainage* |

| Mitigation Action | Likely Benefits | Likely Costs |
|---|---|---|
| | | *Maintenance budget)* |
| Elevate new roads and bridges above the base flood elevation and raise existing low-lying bridges and roads. | • Taking this action helps reduce the risk of major repair costs that might occur if no action were taken.<br>• Solves the problem of bridge and roadway flooding and ensures safe, reliable transportation. | • Very costly action to implement<br>• $30,000 design; $170,000 construction *(Source: 2013-2020 CIP, Capital Reserve Fund)* |
| Protect critical communications and equipment from lightning damage by installing surge protection on critical electronic equipment and backup servers and using battery backups. | • Reduced inconvenience and loss associated with a shutdown of critical facilities due to lightning damage | • $200 per department *(source: 2013-2014 Maintenance—Office Equipment budget)* |
| Protect vulnerable populations from the impacts of extreme temperatures and severe winter storms by establishing heating and cooling centers at designated facilities and providing transportation to and from these centers. | • This action would benefit the entire Town and particularly the most at risk and needy populations.<br>• This action has broad social benefits for the community. | • This action could be costly if it was used outside of a federally declared disaster.<br>• Percentage of $165,079 *(source: 2013-2014 Welfare budget)* |
| Enforce the International Building Code (IBC) and International Residential Code (IRC) to protect buildings and infrastructure from the impacts of earthquakes, flooding, hurricanes, and winter storms. | • This action would be effective at avoiding and reducing future losses.<br>• This action is beneficial to all applicable buildings across the entire Town. | • This action may not benefit older structures not subject to newer building codes.<br>• Percentage of $57,712 *(source: 2013-2014 Building Inspector budget)* |
| Conduct outreach and education programs to increase awareness of earthquakes, extreme temperatures, hurricanes, severe thunderstorms, and severe winter weather. | • The Town currently has the capacity to implement this action.<br>• This action is beneficial to all residents in Town. | • This action may have limited impact because it can be difficult to get people to pay attention to outreach campaigns.<br>• Percentage of $38,275 *(source: 2013-2014 Fire Department Education and Training budget)* |

After completing a Benefit Cost review for each action, the Hazard Mitigation Team then prioritized the actions by conducting a STAPLEE Analysis, which stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental factors. For each mitigation action, the Team asked the following questions:

- Social— Will the action unfairly affect any one segment of the population? Will it disrupt established neighborhoods? Is it compatible with present and future community values? Will it adversely affect cultural resources?
- Technical—How effective is the action in avoiding or reducing future losses? Will it create more problems than it solves? What are some secondary impacts? Does it solve a problem or only a symptom?
- Administrative— Does the community have the capability to implement the action? Can the community provide the necessary maintenance? Can it be accomplished in a timely manner?
- Political— Is there public support both to implement and maintain the action? Is the political leadership willing to support it? Does it present a financial burden to stakeholders?
- Legal— Does the community have the authority to implement the action? Is enabling legislation necessary? What are the legal side effects? Will the community be liable for the actions, support of actions, or lack of actions?
- Economic— What are the costs of this action? How will the costs be borne? Are state/federal grant programs applicable? Does the action fit into existing capital improvements or economic development budgets?
- Environmental— How will this action affect the environment? Does it comply with local, state, and federal environmental regulations? Is it consistent with community environmental goals? Are endangered or threatened species likely to be affected?

The cost and benefit of each mitigation action were then evaluated and assigned a quantitative score based on the STAPLEE criteria.

**Benefit Score Range:** 0 = Not Beneficial, 1 = Somewhat Beneficial, 2 = Beneficial, 3 = Very Beneficial

**Cost Score Range:** 0 = Not Costly, -1 = Somewhat Costly, -2 = Costly, -3 = Very Costly

Next, the scores for each action were added to determine priority. Finally, the Hazard Mitigation Team reviewed the scores and resulting prioritization to make sure it was consistent with the Town's goals and Master Plan. Actions that received the same STAPLEE score will be further prioritized by the Hazard Mitigation Team based on implementation costs. The STAPLEE analysis and prioritized mitigation actions appear in Table 11 below.

**Table 11—STAPLEE Analysis**

| **Mitigation Action:** Map and assess vulnerability to erosion. Conduct stream assessments and prepare fluvial erosion hazard zone maps. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action will not unfairly affect any segment of the population, disrupt established neighborhoods, or adversely affect cultural resources. It is compatible with the community's values of protecting life and property. | 0 | 1 |
| Technical | This action is the first step towards avoiding and reducing future losses from erosion. Mapping and assessment will help to determine how areas at greatest risk of erosion can be targeted for hazard mitigation | 0 | 1 |

| | | | |
|---|---|---|---|
| | opportunities. | | |
| Administrative | NH Department of Environmental Services (NH DES) is the responsible party to implement this action. NH DES is currently conducting fluvial erosion hazard assessments in the Souhegan and Piscataquog River watersheds. This action can be accomplished in a timely manner. Field assessments and analysis will be complete by September 2014. | 0 | 2 |
| Political | There is public support to implement and maintain this action. The political leadership is also willing to support it. | 0 | 1 |
| Legal | NH DES and the Town of Merrimack have the authority to implement the action and no enabling legislation is necessary. | 0 | 1 |
| Economic | The entire cost of this action is being borne by NH DES through a FEMA Pre-Disaster Mitigation grant. There are no costs to the Town of Merrimack. | 0 | 3 |
| Environmental | This action has the potential to reduce property damage and subsequent environmental impacts. | 0 | 2 |
| Subtotal | | **0** | **11** |
| **Total** | | **11** | |
| **Priority** | | **1** | |

| **Mitigation Action:** Conduct outreach and education programs to increase awareness of earthquakes, extreme temperatures, hurricanes, wildfire, severe thunderstorms, and severe winter weather. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action does not unfairly affect any one segment of the population. It is available to all Merrimack residents. | 0 | 2 |
| Technical | This action would help to decrease risk and avoid future loss. | 0 | 2 |
| Administrative (including responsible party) | Merrimack has the capability to implement this action. This action would be the responsibility of Emergency Management. It would be implemented through the Fire and Police Departments using a combination of TV, social media, emergency alerts, and the school district reverse 911 system. | -1 | 2 |
| Political | There is public support to implement and maintain this action. | 0 | 2 |
| Legal | Merrimack has the legal authority to implement this action. | 0 | 1 |
| Economic (including direct cost) | There are no additional costs associated with this project since it is part of the existing Emergency Management budget. | -1 | 1 |
| Environmental | This action has the potential to reduce property damage and subsequent environmental impacts. | 0 | 1 |
| Subtotal | | **-2** | **11** |
| **Total** | | **9** | |
| **Priority** | | **2** | |

**Mitigation Action:** Elevate new roads and bridges above the base flood elevation and raise existing low-

| lying bridges and roads. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action is compatible with present and future community values, including ensuring safe, reliable transportation. This action could be disruptive to residents living near construction. It may also affect property owners if easements are taken. | -1 | 3 |
| Technical | This action solves the problem of bridge and roadway flooding. Steps are also taken to ensure all bridges upstream are at proper elevation to avoid backups. | 0 | 3 |
| Administrative (including responsible party) | Merrimack has the capability to implement and maintain this action. Evaluations of roadways occur annually to ensure it is accomplished in a timely manner. The DPW is the responsible party. | -3 | 2 |
| Political | There is public and political support to implement and maintain this action. | 0 | 2 |
| Legal | Merrimack has the legal authority to implement this action and no enabling legislation is needed. | 0 | 0 |
| Economic (including direct cost) | This action is very costly to implement. It does fit into the existing Capital Improvements budget. | -3 | 3 |
| Environmental | This action is beneficial to the environment by reducing flooding and road washout. | 0 | 3 |
| Subtotal | | **-7** | **16** |
| **Total** | | | **9** |
| **Priority** | | | **2** |

| **Mitigation Action:** Enforce the International Building Code (IBC) and International Residential Code (IRC) to protect buildings and infrastructure from the impacts of earthquakes, hurricanes, winter storms, and tornados. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | There are no social impacts associated with this action. Enforcement would apply evenly across all applicable buildings, including new construction, major renovations, and changes of use. | -1 | 2 |
| Technical | This action is effective at avoiding and reducing future losses and it mitigates the impacts of these hazards. | 0 | 3 |
| Administrative (including responsible party) | Merrimack has the capability to implement this action. Responsibility would fall under the Building Department. | -1 | 2 |
| Political | There is public and political support to implement and maintain this action. | 0 | 1 |
| Legal | Merrimack has adopted these codes and has the legal authority to enforce them. | 0 | 0 |
| Economic (including direct cost) | This action falls under the existing Building Dept. budget and does not impose additional costs to the Town. It could have a positive economic impact by reducing the number of emergency response calls. | 0 | 1 |

| | | | |
|---|---|---|---|
| Environmental | This action has the potential to reduce property damage and subsequent environmental impacts. | 0 | 1 |
| Subtotal | | **-2** | **10** |
| **Total** | | | **8** |
| **Priority** | | | **3** |

| **Mitigation Action:** Protect critical emergency management facilities and equipment from lightning damage. Install and maintain surge protection and battery backup on critical electronic equipment. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action will not unfairly affect any segment of the population, disrupt established neighborhoods, or adversely affect cultural resources. | 0 | 3 |
| Technical | This action is effective in avoiding or reducing future losses. It will not create more problems than it solves. It solves the problem rather than only a symptom. It will reduce the losses incurred from a shutdown of critical facilities due to lightning damage. | 0 | 3 |
| Administrative (including responsible party) | Merrimack has the capacity to implement this action. Each department would be responsible for purchasing and installing their own equipment. It can be accomplished in a timely manner. | -1 | 1 |
| Political | There is public support to implement and maintain this action. The Town Council is also willing to support it. | 0 | 1 |
| Legal | Merrimack has the authority to implement this action. All applicable local and state laws will be followed. | 0 | 0 |
| Economic (including direct cost) | The costs of installing lightning protection devices would be borne by each department under their existing budget. The cost of taking this action is significantly less than the potential costs of damage to critical electronics and facilities. | -2 | 3 |
| Environmental | This action will not impact the environment. | 0 | 0 |
| Subtotal | | **-3** | **11** |
| **Total** | | | **8** |
| **Priority** | | | **3** |

| **Mitigation Action:** Require water conservation by enforcing the year round even/odd water ordinance, which limits the days outside watering is allowed based on street address and date. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action does not unfairly affect any one segment of the population because it is applied evenly to all residents and businesses. It is compatible with present and future community values. | 0 | 0 |
| Technical | The effectiveness of this action depends on the ability of the | 0 | 3 |

| | | | |
|---|---|---|---|
| | Town to enforce it. If followed, it would help to reduce the impacts of drought. | | |
| Administrative (including responsible party) | Merrimack has the capability to implement this action. Merrimack Village District is the responsible party. | 0 | 3 |
| Political | The Town Council supports this action. There is general public support for this action, although some residents are unsatisfied with it. | -1 | 2 |
| Legal | There are no legal issues associated with this action. | 0 | 0 |
| Economic (including direct cost) | Implementation of this action falls under the Merrimack Village District budget. It can be costly to enforce. | -1 | 0 |
| Environmental | This action has a positive impact on the environment by promoting water conservation. | 0 | 2 |
| Subtotal | | **-2** | **10** |
| **Total** | | | **8** |
| **Priority** | | | **3** |

| **Mitigation Action:** Conduct regular maintenance to help drainage systems and flood control structures, including catch basin and swale cleaning. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | There are no social issues associated with this action. It would not unfairly affect any one segment of the population. | 0 | 0 |
| Technical | This action would help to reduce and avoid future losses from flooding. | 0 | 3 |
| Administrative (including responsible party) | The DPW would be responsible for implementing this action. It is part of the Town's regular maintenance program as well as its MS4 permit requirements. There are additional costs associated with reporting. | -1 | 0 |
| Political | There is public and political support for this action. | 0 | 1 |
| Legal | Merrimack has the authority to implement this action. It also has legal requirements to implement this action under its MS4 permit. | 0 | 0 |
| Economic (including direct cost) | This action is costly to implement. It falls under the existing Public Works budget and additional grant funding is sought where available. However, it also has long term economic benefits to the community by reducing flooding. | -2 | 3 |
| Environmental | This action has positive environmental benefits and is consistent with community environmental goals. | 0 | 3 |
| Subtotal | | **-3** | **10** |
| **Total** | | | **7** |
| **Priority** | | | **4** |

| **Mitigation Action:** Protect vulnerable populations from the impacts of extreme temperatures and severe winter storms by establishing heating and cooling centers at designated facilities and providing transportation to and from these centers. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action primarily benefits Merrimack's most vulnerable residents. It is compatible with present and future community values. | 0 | 3 |
| Technical | This action does not solve the problem of extreme temperatures but it does solve the symptom of exposure. | 0 | 2 |
| Administrative (including responsible party) | Emergency Management/Fire Dept. are responsible for organizing heating and cooling centers. A bus company would be hired to provide mass transportation if needed. The Police Dept. would provide transportation in smaller events. | -2 | 3 |
| Political | There is public support to implement and maintain this action. | 0 | 3 |
| Legal | Merrimack has the legal authority to implement this action. | 0 | 0 |
| Economic (including direct cost) | If this action could be costly if it was utilized outside of a federally declared disaster. Costs include food, staffing, and transportation. | -2 | 0 |
| Environmental | There are no environmental impacts associated with this action. | 0 | 0 |
| Subtotal | | **-4** | **11** |
| **Total** | | **7** | |
| **Priority** | | **4** | |

| **Mitigation Action:** Incorporate flood mitigation into local planning. Revise/adopt subdivision regulations and erosion control regulations to improve floodplain management in Merrimack. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action would impact property owners subject to the revised subdivision and erosion control regulations. It would have a positive social impact on the community by reducing flooding. | -1 | 1 |
| Technical | This action helps solve the problem of flood related damage. It is effective in reducing future losses. | 0 | 2 |
| Administrative (including responsible party) | Merrimack has the capability to implement this action. Revisions to regulations require a town vote and public hearing. Community Development is the responsible party for this action. | 0 | 0 |
| Political | There is public support to implement and maintain this action and the Town Council is willing to support it. | 0 | 0 |
| Legal | Merrimack has the legal authority to implement this action. | 0 | 0 |
| Economic (including direct cost) | There are no additional costs to the Town to implement this action because it falls under the existing Community Development budget. There are potential economic costs associated with limiting where development can go. | -1 | 2 |
| Environmental | This action has positive environmental impacts by encouraging erosion control and reduced floodplain development. It is consistent with community environmental goals. | 0 | 3 |

| | | | |
|---|---|---|---|
| Subtotal | | -2 | 8 |
| **Total** | | | 6 |
| **Priority** | | | 5 |

| **Mitigation Action:** Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event. Form partnerships between local, state, and regional entities to expand resources and improve coordination to support floodplain management. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | There are no social impacts related to this action. It will not unfairly affect any segment of the population or disrupt established neighborhoods. It is compatible with present and future community values of working cooperatively with neighboring municipalities. | 0 | 0 |
| Technical | This action may reduce future losses by allowing Merrimack to provide flood aid more quickly. It also helps the Town to know what resources are available for use in an emergency. | 0 | 2 |
| Administrative (including responsible party) | Merrimack has the capability to implement this action and it can be accomplished in a timely manner. Police, Fire, and Public Works departments are each responsible for establishing their own agreements. | -1 | 3 |
| Political | There is public support to implement and maintain this action and the Town Council is willing to support it. | 0 | 1 |
| Legal | Merrimack has the legal authority to implement this action. No enabling legislation is necessary. | 0 | 0 |
| Economic (including direct cost) | The cost of mutual aid calls would be covered by FEMA if the Town was responding to a declared disaster. This action could add costs for non-declared events (ex. overtime to cover Merrimack needs while its staff is elsewhere). | -1 | 1 |
| Environmental | This action has no negative environmental impacts. It could positively benefit the environment by improving floodplain management. | 0 | 0 |
| Subtotal | | **-2** | **7** |
| **Total** | | | **5** |
| **Priority** | | | **6** |

| **Mitigation Action:** Work with FEMA to voluntarily remove structures from flood-prone areas to minimize future flood losses. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action impacts people with structures in the floodplain. It does not unfairly affect any one segment of the population because participation is voluntary. | 0 | 1 |
| Technical | This action would avoid future losses due to flooding. | 0 | 3 |
| Administrative | Merrimack does have the capability to implement this action. | -1 | 0 |

| | | | |
|---|---|---|---|
| (including responsible party) | The Merrimack Finance Dept. would be responsible for this action in cooperation with FEMA. | | |
| Political | It is unclear whether there is public and political support for this action. | -1 | 1 |
| Legal | There are no legal issues associated with this action. FEMA is responsible for purchasing the properties. Merrimack simply facilitates the process. | 0 | 0 |
| Economic (including direct cost) | FEMA covers the administrative costs associated with this action. Merrimack would see a loss of tax revenue from the property, however, emergency response costs would also decrease. | -2 | 1 |
| Environmental | This action would reduce property damage and subsequent environmental impacts. It may also create additional open space in Town, depending on how the parcel was reused. | 0 | 1 |
| Subtotal | | **-4** | **7** |
| **Total** | | | **3** |
| **Priority** | | | **7** |

| **Mitigation Action:** Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets. | | | |
|---|---|---|---|
| **Criteria** | **Evaluation** | **Cost** | **Benefit** |
| Social | This action will not unfairly affect any segment of the population, disrupt established neighborhoods, or adversely affect cultural resources. | 0 | 0 |
| Technical | This action would help to avoid or reduce future losses. It has more potential to solve symptoms related to flooding than the underlying problem itself. It will not create additional problems or cause secondary impacts. | 0 | 1 |
| Administrative (including responsible party) | Merrimack has the capability to implement this action. The Administration Department would be the responsible party to implement this action. It can be accomplished in a timely manner. | 0 | 0 |
| Political | There is public support to implement and maintain this action. The Town Council is also willing to support it. | 0 | 0 |
| Legal | Merrimack has the legal authority to implement the action. | 0 | 0 |
| Economic (including direct cost) | This action is consistent with normal Building Department operations and does not impose additional economic costs. It would take roughly 4 hours of staff time per year to implement. The Building Dept. already has materials, however, there would be additional costs associated with making updates. | -1 | 1 |
| Environmental | This action has the potential to reduce property damage and subsequent environmental impacts only if the recommendations in the literature are implemented. | 0 | 0 |
| Subtotal | | **-1** | **2** |
| **Total** | | | **1** |

| Priority | | 8 |
|---|---|---|

## Section 4.4 ~ Implementing and Administering Mitigation Actions

The Town of Merrimack has incorporated and will continue to integrate requirements of the Merrimack Hazard Mitigation Plan Update 2014 into other planning mechanisms. For example, hazard assessments from the Merrimack Hazard Mitigation Plan Update 2014 will be integrated into the Emergency Response Plan.

In addition, updates to Merrimack's Capital Improvement Plan will include any applicable mitigation projects identified in the Hazard Mitigation Plan, such as drainage improvements. The next update to the Town's Master Plan will also incorporate elements of the Hazard Mitigation Plan where applicable.

The Merrimack Hazard Mitigation Team will be responsible for helping Town boards and departments to integrate the Hazard Mitigation Plan into their own planning mechanisms.

The Hazard Mitigation Team developed Table 12, which is an action plan that outlines who is responsible for implementing the prioritized mitigation actions, how they will be funded, and when they will be completed.

**Table 12—Implementation and Administration**

| Mitigation Action | Responsible Party | Cost & Funding | Timeframe |
|---|---|---|---|
| Map and assess vulnerability to erosion. Conduct stream assessments and prepare fluvial erosion hazard zone maps. | NH Department of Environmental Services | Cost = $0<br><br>Funding Source: FEMA Pre-Disaster Mitigation Grant | Anticipated Completion by September 2015 |
| Conduct outreach and education programs to increase awareness of earthquakes, extreme temperatures, hurricanes, wildfire, severe thunderstorms, and severe winter weather. | Merrimack Fire and Police Departments | Cost = percentage of $38,275<br><br>Funding Source: Fire Dept. Education and Training budget | Anticipated Completion by April 2015 |
| Elevate new roads and bridges above the base flood elevation and raise existing low-lying bridges and roads. | Merrimack Department of Public Works | Cost = $30,000 design; $170,000 construction<br><br>Funding Source: Capital Reserve Fund | Anticipated Completion by June 2018 |
| Enforce the International Building Code (IBC) and International Residential Code (IRC) to protect buildings and infrastructure from | Merrimack Building Department | Cost = percentage of $57,712<br><br>Funding Source: | Anticipated Completion by August 2015 |

| Mitigation Action | Responsible Party | Cost & Funding | Timeframe |
|---|---|---|---|
| the impacts of earthquakes, hurricanes, winter storms, and tornados. | | Building Inspector budget | |
| Protect critical emergency management facilities and equipment from lightning damage. Install and maintain surge protection and battery backup on critical electronic equipment. | Each Department | Cost = $200 per department<br><br>Funding Source: Maintenance—Office Equipment budget for each department | Anticipated Completion by May 2016 |
| Require water conservation by enforcing the year round even/odd water ordinance, which limits the days outside watering is allowed based on street address and date. | Merrimack Village District | Cost = $4,400 Advertising & Public Information; $500 Public Education<br><br>Funding Source: Merrimack Village District | Anticipated Completion by June 2017 |
| Conduct regular maintenance to help drainage systems and flood control structures, including catch basin and swale cleaning. | Merrimack Department of Public Works | Cost = $10,000<br><br>Funding Source: Highway Department Drainage Maintenance budget | Anticipated Completion by March 2015 |
| Protect vulnerable populations from the impacts of extreme temperatures and severe winter storms by establishing heating and cooling centers at designated facilities and providing transportation to and from these centers. | Merrimack Fire Department | Cost = percentage of $165,079<br><br>Funding Source: Welfare budget | Anticipated Completion by December 2016 |
| Incorporate flood mitigation into local planning. Revise/adopt subdivision regulations and erosion control regulations to improve floodplain management in Merrimack. | Merrimack Community Development Department | Cost = percentage of $66,604<br><br>Funding Source: Planning/Zoning Administrator budget | Anticipated Completion by March 2018 |
| Establish mutual aid agreements with neighboring communities to address administering the NFIP following a major storm event. | Merrimack Fire, Police, Department of Public Works | Cost = percentage of $9,380<br><br>Funding Source: Fire | Anticipated Completion by March 2017 |

| Mitigation Action | Responsible Party | Cost & Funding | Timeframe |
|---|---|---|---|
| Form partnerships between local, state, and regional entities to expand resources and improve coordination to support floodplain management. | | Department Emergency Management budget | |
| Work with FEMA to voluntarily remove structures from flood-prone areas to minimize future flood losses. | FEMA in cooperation with Merrimack Finance Department | Cost = $0<br><br>Funding Source: FEMA | Anticipated Completion by April 2019 |
| Prepare, distribute, or make available NFIP, insurance, and building codes explanatory pamphlets. | Building Department | Cost = $200<br><br>Funding Source: Code Enforcement Clerical Wages | Anticipated Completion by June 2015 |

# CHAPTER 5. PLAN ADOPTION

## Section 5.1 ~ Formal Adoption by Governing Body

CERTIFICATE OF ADOPTION

Town of Merrimack, NH TOWN COUNCIL

**A RESOLUTION ADOPTING THE TOWN OF Merrimack, NH HAZARD MITIGATION PLAN UPDATE 2014**

WHEREAS, the Town of Merrimack has historically experienced damage from natural hazards and it continues to be vulnerable to the effects of earthquake, extreme temperatures, flooding, fluvial erosion, hurricane/tropical storm, severe thunderstorm, severe winter weather, tornado, and wildfire, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the City/Town of _____, has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its Hazard Mitigation Plan Update 2014 under the requirements of 44 CFR 201.6; and

WHEREAS, public and committee meetings were held between _____ and _____ regarding the development and review of the Hazard Mitigation Plan Update **2014;** and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Merrimack and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Merrimack, with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this Plan will make the Town of Merrimack eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Town Council:

1. The Plan is hereby adopted as an official plan of the Town of Merrimack
2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.
4. An annual report on the progress of the implementation elements of the Plan shall be presented to the Town Council by Merrimack Hazard Mitigation Team

**IN WITNESS WHEREOF,** the undersigned has affixed his/her signature and the corporate seal of the Town of Merrimack this ---th day of _____, ***2014***

## Section 5.2 ~ FEMA Approval Letter